SAMPLE PAPER
CLASS – XII
SUBJECT – MATHEMATICS

TIME –3 HOURS MAX. MARKS -100

NAME : ____ ROLL. NO. : _____________

Instructions:
1. *All questions are compulsory.*
2. *The question paper is printed on two pages and consists of 29 questions divided into four sections A, B, C and D.*
   Section A contains 4 questions of 1 mark each, Section B is of 8 questions of 2 marks each, Section C is of 11 questions of 4 marks each and Section C is of 6 questions of 6 marks each.
3. *There is no overall choice. However, internal choices are provided in section C and section D only.*
4. *Write the serial number of the question before attempting it.*
5. *Use of calculators is not permitted. However, you may ask for Mathematical tables if needed.*
6. *Cancel the previous question, if attempted again, for any reason.*

Q. No.	**Question**	**Max Marks**
	SECTION A	
Q.1	Consider $f:[1,2,3] \to [a,b,c]$ given by $f(1) = a, f(2) = b$ and $f(3) = c$. Find f^{-1}	1
Q.2	If $\begin{vmatrix} 2x+3 & 3 \\ 5x+2 & 9 \end{vmatrix} = 0$, find the value of x	1
Q.3	If $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}, \vec{b} = \hat{\imath} - 3\hat{k}$, find $\lvert \vec{b} \times 2\vec{a} \rvert$	1
Q.4	Let * be a binary operation defined by $a * b = 2a + b - 3$. Find $3 * 4$	1
	SECTION B	
Q.5	Prove that: $\cos\left(\cos^{-1}\frac{3}{5} + \cot^{-1}\frac{3}{2}\right) = \frac{6}{5\sqrt{13}}$	2
Q.6	If A is a square matrix such that $A^2 = I$, then find the value of $(A-I)^3 + (A+I)^3 - 7A$	2
Q.7	If $e^x + e^y = e^{x+y}$, prove that: $\frac{dy}{dx} = -e^{y-x}$	2
Q.8	Find the approximate change in the volume V of a cube of side x metres caused by increasing the side by 2%	2
Q.9	Evaluate: $\int \frac{1}{x\cos^2(1+\log x)} dx$	2
Q.10	Form the differential equation of the family of ellipses having their foci on x-axis and vertex at the origin.	2
Q.11	Find a vector of magnitude $3\sqrt{2}$ which makes an angle of $\frac{\pi}{4}$ and $\frac{\pi}{2}$ with y and z axes respectively.	2
Q.12	Two dice are thrown. If it is known that the sum of the numbers on the dice was less than 6, find the probability of getting a sum 3.	2
	SECTION C	
Q.13	Given $A = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}, B = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$, find BA and use this to solve the system of equations: $y + 2z = 7, x - y = 3, 2x + 3y + 4z = 17$	4

Q. No.	Question	Max Marks
Q.14	If the function defined by : $f(x) = \begin{cases} \frac{\sqrt{x+bx^2}-\sqrt{x}}{bx^{3/2}}, x > 0 \\ \frac{\sin(a+1)x+\sin x}{x}, \ x < 0 \\ c, \ x = 0 \end{cases}$ is continuous at $x = 0$ then find the values of a, b and c	4
Q.15	If $x = \sin t, y = \sin pt$, prove that $(1 - x^2)y_2 - xy_1 + p^2y = 0$	4
Q.16	If the straight line $x\cos\alpha + y\sin\alpha = p$ touches the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, prove that: $a^2cos^2\alpha + b^2sin^2\alpha = p^2$ OR Find the interval in which the function $f(x) = \sin x + \cos x, 0 \leq x \leq 2\pi$ is increasing or decreasing	4
Q.17	Show that the volume of the largest cone that can be inscribed in a sphere of radius R is 8/27 of the volume of the sphere.	4
Q.18	Integrate: $\int \frac{\sqrt{1+x^2}}{x^4} dx$	4
Q.19	Find the equation of the curve passing through origin such that the slope of the tangent to the curve at any point (x, y) is equal to the sum of the coordinates of the point.	4
Q.20	Prove that for any three vectors, $\vec{a}, \vec{b}, \vec{c}$: $[\vec{a} + \vec{b} \ \ \vec{b} + \vec{c} \ \ \vec{c} + \vec{a}] = 2[\vec{a} \ \vec{b} \ \vec{c}]$	4
Q.21	Find the foot of perpendicular from the point P(1,6,3) on the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$. Also, find its distance from P.	4
Q.22	A letter is known to have come from TATANAGAR or CALCUTTA. On the envelope just two consecutive letters TA are visible. What is the probability that letter has come from CALCUTTA	4
Q.23	Find the probability distribution of the maximum of the two scores obtained when a die is thrown twice. Determine also the mean of the distribution	4
	SECTION D	
Q.24	Let X be a non-empty set and P(X) be its power set. Let * be an operation defined on elements of P(X) by A*B = $A \cap B \forall A, B \in P(X)$ (i) Prove that * is a binary operation on P(X) (ii) Is * commutative (iii) Is * associative (iv) Find the identity element in P(X) w.r.t. * (v) Find all the invertible elements of $P(X)$ (vi) If o is another operation defined on P(X) as AoB = $A \cup B$, then verify that o distributes over *.	6
Q.25	If $a \neq p, b \neq q, r \neq c$ and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$, find the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c}$	6
Q.26	Find the area of the region bounded by the parabola $y^2 = 2x$ and the straight line $x - y = 4$	6
Q.27	Evaluate: $\int_0^\pi x \log \sin x \, dx$ using properties of integrals **OR** Evaluate $\int_0^2 (x^2 + x)dx$ as the limit of sum	6
Q.28	Find the equation of the plane passing through the line of intersection of the planes $2x + 3y - z + 1 = 0$ and $x + y - 2z + 3 = 0$ and perpendicular to the plane $3x - y - 2z - 4 = 0$.Also find the inclination of this plane with the xy-plane.	6

Q. No.	Question	Max Marks
Q.29	A company manufactures three kinds of calculators, A, B and C in its two factories I and II. The company has got an order for manufacturing at least 6400 calculators of kind A, 4000 of kind B and 4800 of kind C. The daily output of factory I is of 50 calculators of kind A, 50 calculators of kind B and 40 of kind C. The cost per day to run factory I is Rs. 12, 000 and of factory II is Rs. 15,000. How many days do the two factories have to be in operation to produce the order with the minimum cost? Formulate this as an LPP and solve it graphically.	6

*****ALL THE BEST*****